# Risk Communication

## Description

Risk communication is a dialogue–an interactive process of information exchange–among the Site Team and the community that discusses the nature of risk and other concerns. This dialogue should be a genuine and sincere conversation that aims to identify mutual solutions and respond to public concerns.

## Required Activity?

No. The specific risk communication techniques contained in this tool are suggestions. However, the general process of risk communication is implied by the National Contingency Plan (NCP). For removal actions, the NCP [at 40 CFR § 300.415 (n)(1)] requires that a spokesperson be designated by the lead agency to inform the community of actions taken, respond to inquiries, and provide information concerning the release (i.e., the contamination). For remedial actions, the NCP [at 40 CFR § 300.430(c)(2)(C)] requires that the lead agency provide appropriate opportunities for the community to learn about the release and the affected area (a.k.a., "the site"). Explaining the risk assessment process is an essential component of risk communication and involving communities in the Superfund risk assessment process, as outlined in Risk Assessment Guidance for Superfund (RAGS), Volume 1 - Human Health Evaluation Manual Supplement to Part A: Community Involvement in Superfund Risk Assessments.

## Making It Work

Communities are entitled to make decisions about issues that directly affect them, and EPA is committed to promoting participation in the decision-making process by people whose lives are affected by Superfund sites. Effectively communicating information on site-related hazards and risks is a multi-step process that involves:

- Identifying and understanding your audience.
- Defining clear messages that provide the information you want to convey with an understanding of, and respect for, the audience's concerns and perceptions.
- Selecting appropriate communication methods to deliver those messages.

Keep in mind that even an effective risk communication process does not guarantee consensus on the appropriate cleanup approach among all affected parties. **The goal of risk communication is to increase the community's involvement in the cleanup process, the Agency's awareness of the community's perception of site-related risks, and the public's understanding of how the Agency uses risk assessment in decision-making at a site.** All members of the Site Team, including On-Scene Coordinators; Remedial Project Managers; Risk Assessors; Community Involvement Coordinators; state, tribal, and local government partners; and staff from the Agency for Toxic Substances and Disease Registry should be involved in planning and implementing risk communication.

### Why is Risk Communication Important?

Risk communication provides an opportunity for the Agency and the community to exchange information, facilitates community participation in the decision-making process, helps the Site Team understand and appreciate the community's perception of risk, and helps establish mutual trust and a productive relationship between EPA and the community.

Community members often have important information that can help improve the accuracy of the site characterization and the baseline human health risk assessment. Local community knowledge can help the site team:

- Better understand the site's history and the type and extent of contamination.
- More accurately characterize exposure pathways due to human behavior.
- Identify unique ways in which the community uses local resources, such as consuming high



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quantities of one type of food (e.g., fish from a contaminated river) or incorporating plants grown near the contaminated site into food, medicinal remedies, or traditional practices.
- Develop appropriate exposure scenarios and cleanup approaches by identifying suitable future land uses.
- Become aware of whether certain segments of the community may have a disproportionate burden of exposure or environmental health effects due to race/ethnicity, national origin, or income compared to other nearby communities (i.e., issues related to environmental justice).

## When is Risk Communication Used?

Effective risk communication begins early in the Superfund cleanup process. The remedial investigation stage is a good place to initiate risk communication. The community needs to understand how the Agency arrives at the determination of risk, what information is used, how the information is used, which uncertainties are inherent in the process, and how uncertainties are addressed. Members of the Site Team should be prepared to discuss site-related risks at any point in the Superfund cleanup process, such as:

- During the site assessment stage, when residents may be asked to allow EPA to sample on their property.
- During the remedy selection stage, when the Site Team works to help people understand the technical aspects of the cleanup approaches.
- During the construction completion stage, when the discussion may focus on the future of the site and returning it to productive use.

All Site Team members should familiarize themselves with the Superfund human health risk assessment process[1] and how it is used in site decision-making regarding risk management. Knowing these processes will help you answer technical questions from the public more effectively. When discussing site-related risks with the community, it is important for the Site Team to present consistent key risk messages to avoid confusion and maintain credibility and trust with the community.

1 EPA. 2000. Presenter's Manual for: Superfund Risk Assessment and How You Can Help, EPA/540/R-99/013. Found at: http://www.epa.gov/oswer/riskassessment/pdf/vdmanual.pdf.

## Defining Risk and Risk Perception Factors

Any explanation of the risk around a Superfund site must be coupled with a recognition of the issues that are driving the public's perception of risk at the site. **Effective risk communication is based on an understanding that risk means different things to different people.** To a risk assessor, risk might be a quantitative probability that damage to life, health, and/or the environment will occur as a result of a given hazard[2] (i.e., the "probability of a future loss"[3]). However, the general public does not judge risk based on numbers or statistics alone. Instead, risk is both a real and a *perceived* threat of an event occurring. It also is a judgment people make about the likelihood, severity, or importance of a threatening event or condition.[4]

Researchers have identified a set of risk perception factors that contribute to the way the public perceives a risk, which include: voluntariness, controllability, familiarity, fairness, catastrophic potential, reversibility, equity, and effects on children (Attachment 1 contains a comprehensive list of qualitative factors affecting risk perception). For example, a situation that seems to put children specifically at risk will be perceived as having a higher risk than a situation that does not. Similarly, risks arising from a situation that is not familiar to the community, such as leaching of contaminants into groundwater, will be perceived to be higher than risks arising from a familiar situation (e.g., people in mining communities who have lived next to slag piles their entire lives). People use their instincts and life experience to gauge how risky a situation is.[5]

## How to Do Effective Risk Communication

Using effective strategies to deliver important risk-communication messages will convey the information the Site Team needs to communicate

2 EPA. 2009. "Risk." Terms of Environment: Glossary, Abbreviations, and Acronyms.

3 Byrd, D. and C. Cothern. 2000. Introduction to Risk Analysis: a Systematic Approach to Science-Based Decision Making. Government Institutes, Rockville, Maryland, USA.

4 EPA. 2007. Risk Communication in Action: The Tools of Message Mapping. U.S. Environmental Protection Agency. EPA-625-R-06-012.

5 From David Ropeik, Risk Communication: More than Facts and Feelings. IAEA Bulletin, Vol. 50-1, International Atomic Energy Association. Found at: http://www.iaea.org/Publications/Magazines/Bulletin/Bull501/Risk_Communication.html.

while addressing the community's needs, concerns, and site-related expectations. Before you begin the risk communication process, consider the type of communication environment you are working in and adjust accordingly. There are essentially four types of communication environments:

| Concern ↑ / Trust → | |
|---|---|
| High Concern<br>Low Trust<br>(1) | High Concern<br>High Trust<br>(2) |
| Low Concern<br>Low Trust<br>(3) | Low Concern<br>High Trust<br>(4) |

High concern and low trust environments (1) in particular create barriers that can completely impede the flow of information during communication. Gaining the community's trust and building a sense of confidence in the Site Team is of utmost importance. Trust and credibility can be built through communication that considers the audience and the community's perception of risk, provides clear and concise messages that carry positive information, and uses an effective delivery mechanism (as described in the following sections).

The key to effective risk communication is preparation. Once risk perception factors have been identified, use the following three steps to help you communicate risk to the community: (1) identify the audience and their questions/concerns; (2) develop risk messages; (3) deliver your messages.

## Step 1 - Identify the Audience and their Questions/Concerns

Risk communication is more effective if the type, content, and distribution of outreach products are specifically tailored to the target audience. The community's response to the messages you convey can be driven by risk perception factors or other site-specific concerns or fears, such as their health and the health of their family, property values, liability, and damage to the environment.

As you would do when developing a *Communication Strategy*, start by looking at a wide range of interested parties. The target audience may include the general public, landowners, local businesses, schools, developers, activist groups, community groups, or the *Media*. To help identify your audience, ask yourself questions such as:

- Who is the current landowner?
- Have there been recent instances of public concern about other local issues? If so, then

As you interact with the community and prepare your risk communication strategy for the site, remember the *Seven Cardinal Rules of Risk Communication*[1]:

1. **Accept and involve the public as a legitimate partner** through early involvement of the community and all other parties that have an interest in the issue.
2. **Plan carefully and evaluate your efforts.** Successful risk communication planning involves having clear objectives, being attentive to the needs and interests of various groups, training staff in communication skills, rehearsing and testing your message, and assessing efforts and lessons learned.
3. **Listen to the public's specific concerns** by taking the time to find out what people know, think, or want, and recognizing their feelings.
4. **Be honest, frank, and open.** Try to share more information with the community, not less; otherwise, people may think you are hiding something.
5. **Coordinate and collaborate with other credible sources.** Take the time to coordinate with other organizations and credible sources and jointly communicate the issue.
6. **Meet the needs of the media** by being open with and accessible to reporters. Establish long-term relationships of trust with specific editors and reporters.
7. **Speak clearly and with compassion.** Communicate on a personal level by using vivid, concrete images or examples and anecdotes that make technical risk data come alive. Acknowledge and respond with the words and emotions that people express–anxiety, fear, anger, outrage, and helplessness.

1 Covello, V. and F. Allen. 1988. Seven Cardinal Rules of Risk Communication. U.S. Environmental Protection Agency, Office of Policy Analysis, Washington, D.C.

local action groups or local media may be the existing stakeholders.
- Are any schools, colleges, or nursery facilities located in the vicinity?
- Are healthcare facilities (e.g., doctor offices, urgent care centers, hospitals) located in the vicinity?
- Any there religious/sacred buildings or tribal sacred/cultural landmarks nearby?
- What are the appropriate regulatory bodies for both human health and environmental considerations?

Review the site's *Community Involvement Plan* (CIP) to better understand the characteristics of the community, as well as the community's needs, concerns, and site-related expectations. If a CIP is not available or out of date, developing a new *Community Profile* that describes the affected community is a good idea.

After identifying your audience, prepare a list of key questions and concerns for each major group of stakeholders (See *Attachment 2*, *Frequently Asked Questions at Superfund, Environmental Cleanup, and Hazardous Waste Sites*). These questions generally fall into three broad categories:

- Overarching questions that are broad in topic and focus on the general status of a situation.
- Informational questions that ask about a specific aspect of the situation.
- Challenging questions that tend to be hostile or tense in tone.

Analyze the answers to these questions to identify the underlying concern.

## Step 2 - Develop Risk Messages

After identifying your potential audiences, define the key risk messages you want to convey. Use a message map to help you. A message map is a detailed description of hierarchically organized answers to anticipated questions and concerns from stakeholders in the event of a disaster, crisis, or alarming situation. Creating a message map allows you to think through tough questions and deliver consistent messages for multiple stakeholders and communication outlets. A message map should bring focus and clarity to potentially high-stress, high-concern, or emotionally charged situations.

A message map has three main components, or tiers:

- **Tier 1** identifies the audience and the question being addressed.
- **Tier 2** consists of the key messages pertaining to the situation. Consider the information that you want to convey and the main information your community wants and needs to know. Identify **three** key messages to deliver to your audience, keeping each key message to nine words or less. Your three key messages together should be about 27 words.
- **Tier 3** provides supporting information for the three key messages. Like your key messages, supporting information should consist of details the community wants and needs to know about the situation. Supporting information should address the audience's perception of risk. For example, you may want to acknowledge that the situation is unfamiliar to the community or that the situation may specifically pose risks to children.

Use the following template to help you develop your message map (*Attachment 3* also contains a blank message map that can be used as a template). Note that message maps are a way to guide you in delivering risk information to the public. They are not meant to be read verbatim. Their purpose is to provide consistency throughout all venues of communication between the Site Team and the public, thereby increasing the credibility of the Agency and building trust in the community.

Message Map Template

| QUESTION |
|---|
| Audience/Stakeholder:<br>"Core" Concern: |
| |
| Key Message #1 (most important)<br>▪ Supporting information<br>▪ Supporting information<br>▪ Supporting information |
| Key Message #2<br>▪ Supporting information<br>▪ Supporting information<br>▪ Supporting information |
| Key Message #3<br>▪ Supporting information<br>▪ Supporting information<br>▪ Supporting information |

### Step 3 - Deliver Your Messages

Effectively deliver the risk message by selecting appropriate communication methods, addressing communication barriers, and managing difficult situations. Again, the key is preparation. Use the *Communication Strategies Tool*, which provides a thorough discussion on selecting appropriate communication methods, as well as the site's CIP, which outlines a site-specific communication plan with preferred communication delivery mechanisms.

Risk messages can be delivered via interactive forums such as public meetings, workshops, and one-on-one discussions, as well as through indirect means such as media appearances and publications (e.g., pamphlets, fact sheets, handbooks, etc.). Messages delivered through indirect means must include information about how EPA plans to collect and respond to community feedback, questions, and concerns. Partner with local community or cultural institutions to assist in conveying risks in appropriate cultural and trusted ways (for example, on fish consumption advisories).

## Additional Considerations for Explaining Risk

Help the community to interpret risk information and put risk-related data into perspective. This can be accomplished by the following:

**Explain the Superfund risk assessment process.** This is a critical component of risk communication and is best done early and often. Consider holding a risk assessment workshop to explain the risk assessment process *before* the risk assessment is started. Reviewing the process can help demonstrate that the risk numbers are not derived from a "black box." A 40-minute video–*Superfund Risk Assessment and How You Can Help*–helps explain in plain terms the Superfund human health risk assessment process and how communities can be involved. The video, along with a short 10-minute overview should be available through your Regional Community Involvement Manager. The accompanying *Presenter's Manual* highlights the key messages described in the video and other issues that audiences might raise.

**Explain the significance of exposure pathways (i.e., routes of exposure).** Frequently, the issue is not whether a dangerous contaminant exists in relatively high quantities, but whether exposure to the contaminant puts people at risk. Help the community understand that for a risk to exist, the following three factors must be present: 1) contamination; 2) pathways for that contaminant to reach surrounding populations; and 3) populations that may be exposed to the contaminant. If any of these factors are missing, little or no risk is present. If all three factors are present, explain the exposure pathways (the course a substance takes from its source to contact with people) as well as the exposure route (means of entry of the substance into the body).

**Involve the community in the risk assessment process.** A good opportunity for community involvement in the risk assessment process is during the exposure assessment step. Exposure information may be gathered from the public during *Community Interviews* or through a *Workshop*.

**Apply indexing or color-coding to explain sampling data.** "Indexing" is a data interpretation tool that expresses one or more quantitative measurements as part of a scale, such as "poor" to "excellent." Indexing requires the development of weighting factors where important variables are assigned more weight than less important factors to combine the relevant data into an index scale (*Attachment 4* provides a series of steps that can help in developing an index). Complex data may be difficult to categorize and summarize.

Color coding is a type of indexing that works well with maps, graphs, icons, and other risk communication tools. Appropriate choices of colors (and ranges of colors) can enhance a viewer's understanding. However, keep in mind that some individuals may be color blind. In addition, color printing may not be readily available in all locations. As with indexing, the biggest challenge with color coding is reaching a consensus of where the "green" ends and the "yellow" begins.

**Color Coding Example**

At the XXX Superfund site, color-coding can help homeowners interpret results of lead screening in their yards and explain EPA's planned course of action for their properties.

| RANGE (mg/kg LEAD) | COLOR | GUIDANCE TO HOMEOWNER | NECESSARY ACTIONS |
|---|---|---|---|
| 0-399 | No Color (Clear) | Below Levels of Concern | No action planned |
| 400-799 | Yellow | Homeowners should practice caution when handling soil. Small children (0-7) years of age) should be monitored closely when allowed in the area specifically in regard to putting hands to face. Bare soils should be covered with several inches of clean material and off limits to playing children. | Further evaluation of the area is necessary. Actions to address the area is likely by the remedial program. |
| 800 and Up | Red | Small children (0-7) years of age) should be discouraged from playing in the area. Homeowners should practice caution when handling soil. Bare soil should be covered with at least 3 inches of clean material (mulch for example) or have grass established (or sod applied). | Excavation of the area is pending. |

**Use visuals to describe complex scientific concepts.** Data visualization tools present information primarily through images like maps, icons, and pie charts, rather than through words, enabling you to communicate results to a broader audience. Here are some examples of visuals:

- **Diagrams** can be useful to show exposure pathways of contaminants in a groundwater plume.
- **Maps** can display the current contamination and predicted paths of migration, as well as illustrate "receptors" of the contamination (see the *Maps and Aerial Photographs* tool for more information).
- **Graphs** can be used to show the decrease of contamination over time.
- **Geographic information systems** (GIS), e.g., Google Earth, can be used to display multiple "layers" of information at a Superfund site, such as population demographics, water resources, roads, and other features of the area.
- **3-D data visualization tools** create realistic simulations and display environmental information in a three-dimensional space, which can help the community better understand site conditions, depth of contamination, and other environmental data.

**Use risk comparisons effectively and cautiously.** Risk comparisons can be an effective strategy to provide context for a situation and help individuals put site-related risks in perspective. However, an inappropriate comparison can have disastrous results for the credibility and efforts of the communicator. Below is a list of some acceptable and unacceptable uses of risk comparisons:

| Acceptable Risk Comparisons | Example |
|---|---|
| Comparing risk level of the solution to risk from lack of action | Informing the community that if PCBs are allowed to remain in the sediment and fish continue to be exposed to the contaminants, this would make the risks far greater than those that would be incurred by removing the contaminant and disposing of it in a landfill. |
| Before and after comparisons | The community is concerned about the safety of a remedial or removal action at the site. It is acceptable to tell them that by removing contaminated sediment, the risk of eating fish from the river will be lowered tenfold. |
| Comparing site contaminant levels to regulatory standard levels for that contaminant<br>*Note: When using this approach, it is important to explain what regulatory standard levels are being used and how they are derived; some contaminants, such as lead, do not have a safe or acceptable level.* | Informing the community that the concentration of copper in their water is half the Agency's Maximum Contaminant Level drinking water standard for the nation. |
| *No matter how small the risk, never present any level of risk as "acceptable." Community members should make their own determinations about what they consider safe. | |

| Unacceptable Risk Comparisons | Example |
|---|---|
| Comparing voluntary risks to involuntary risks | Comparing health risks from smoking or driving to health risks from groundwater contamination. |
| Trivializing risk | Stating that one has a greater chance of developing cancer from a contaminant in peanut butter than from living near a Superfund site. |

## Tips

- **Earn trust and establish credibility.** A credible person is accurate, keeps promises (and makes sure others do the same), listens to the community, and appreciates their concerns. Trust and credibility are difficult to earn; once lost, they are extremely difficult to regain.
- **Inform the public of Superfund's mandate** to address human health and environmental threats from site-related hazardous waste, rather than achieving zero-risk or to return waste sites to their best use.
- **Develop a risk communication strategy** to plan all risk communication carefully by integrating the risk assessment and management activities with other community involvement activities.
- **Make use of outside experts**, but continue to serve as the lead contact person for the communication of technical risk information.
- **Coordinate all communication**, including risk communication, with the Site Team. Do not act alone.
- **Select your messages with care.** Problems often arise when either too much or too little information is provided.
- **Be transparent.** Do not withhold information unless there is a plausible reason for doing so and that reason is communicated to the community.
- **React honestly and admit to mistakes and past problems.** Let the community know that EPA is trying to do better, and acknowledge how difficult it is for experts to remember that most people need more background information to understand some concepts.
- **Be patient and compassionate.** The Site Team needs to empathize with the community. Remember, every new audience is hearing this information for the first time and many people must hear information more than once. Show the audience that you are listening to their position and concerns (See *Attachment 5* for a list of helpful phrases in non-judgmental language). Remember that people often do not care what you know until they know how much you care.
- **Return telephone calls or e-mails within 24 hours.** If the answer to a question is not ready, explain what is being done to investigate and when an answer will be available.
- **Use the Seven Cardinal Rules of Risk Communication as a guide.**

## Related Tools

- Communication Strategies
- Community Groups
- Community Interviews
- Community Involvement Plans
- Community Profile
- Computer-Based Resources
- Cross-Cultural Communication
- Exhibits
- Fact Sheets
- Focus Groups
- Maps and Aerial Photographs
- Media
- Presentations
- Public Availabilities/Poster Sessions
- Public Meetings
- Public Notices
- Technical Assistance For Communities
- Telephone
- Translation Services
- Videos
- Workshops

## Other Sources of Information

1. *U.S. EPA Community Involvement Handbook* http://www.epa.gov/superfund/community/cag/pdfs/ci_handbook.pdf
2. *U.S. EPA Community Involvement Toolkit* http://www.epa.gov/superfund/community/toolkit.htm
3. *Program Evaluation: An Internal Review of Procedures for Community Involvement in Superfund Risk Assessment.* U.S. EPA, Office of Solid Waste and Emergency Response. http://www.epa.gov/evaluate/pdf/waste/internal-review-procedures-community-involvement-superfund-risk-assessments.pdf
4. *Presenter's Manual for: "Superfund Risk Assessment and How You Can Help."* U.S. EPA, Office of Solid Waste and Emergency Response. http://www.epa.gov/oswer/riskassessment/pdf/vdmanual.pdf.
5. *Risk Communication in Action: Environmental Case Studies.* U.S. EPA, Office of Research and Development. EPA/625/R-02/011: http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=30004IX9.txt
6. *Risk Communication in Action: The Tools for Message Mapping.* U.S. EPA, Office of Research and Development. EPA/625/R-06/012: http://www.epa.gov/nrmrl/pubs/625r06012.html
7. *77 Questions Commonly Asked by Journalists During an Emergency or Crisis.* From Covello, V.T. "Keeping Your Head in a Crisis: Responding to Communication Challenges Posted by Bioterrorism and Emerging Infectious Diseases." http://riskcomm.org/new/wp-content/uploads/2012/03/Questions-Commonly-Asked-by-Journalists-Buring-an-Emerency-Crisis.doc

## Attachments

- Attachment 1: Qualitative Factors Affecting Risk Perception
- Attachment 2: Frequently Asked Questions at Superfund, Environmental Cleanup, and Hazardous Waste Sites
- Attachment 3: Blank Message Map; Example Message Map
- Attachment 4: The Four Steps to Indexing
- Attachment 5: Non-Judgmental Language – Helpful Phrases
- Attachment 6: Useful Terms and Definitions for Explaining Risk

# Attachment 1: Qualitative Factors Affecting Risk Perception

| Factor | Conditions Associated with Increased Public Concern | Conditions Associated with Decreased Public Concern |
|---|---|---|
| Catastrophic Potential | Fatalities and injuries grouped in time and space | Fatalities and injuries scattered and random |
| Familiarity | Unfamiliar | Familiar |
| Understanding | Mechanisms or process not understood | Mechanisms or process understood |
| Controllability (own) | Uncontrollable | Controllable |
| Exposure Willingness | Involuntary | Voluntary |
| Effects on Children | Children specifically at risk | Children not specifically at risk |
| Effects Manifestation | Delayed effects | Immediate effects |
| Future Generation Effects | Risk to future generations | No risk to future generations |
| Victim Identification | Identifiable victims | Statistical victims |
| Dread | Effects dreaded | Effects not dreaded |
| Trust in Institutions | Lack of trust in responsible institutions | Trust in responsible institutions |
| Media Attention | Much media attention | Little media attention |
| Accident History | Major and/or minor accidents | No major or minor accidents |
| Equity | Inequitable distribution of risks and benefits | Equitable distribution of risks and benefits |
| Benefits | Unclear benefits | Clear benefits |
| Reversibility | Effects irreversible | Effects reversible |
| Origin | Caused by human actions/ failures | Caused by acts of nature/God |

National Research Council. 1989. *Improving Risk Communication.* Washington, DC: The National Academies Press.

# Attachment 2: Frequently Asked Questions at Superfund, Environmental Cleanup, and Hazardous Waste Sites

## Site-Specific Questions

1. What are the contaminants of concern?
2. How much contamination is there?
3. How widespread is the contaminant?
4. Is the contamination moving, and if so, in what direction?
5. Where did the contamination come from?
6. Who brought it to your attention?
7. Are there any other contaminants besides the ones we were told about?
8. How can you be sure there are no other contaminants?
9. How will you decide where to sample and where not to sample?
10. Who is responsible for cleaning up the contamination?
11. Who is going to perform the cleanup?
12. How long will the cleanup take?
13. What about schools nearby?
14. When will you start cleanup?

## Investigation/Data Concerns

1. Do I have to give you access to sample my property?
2. What if I refuse access to my property?
3. Would EPA take samples on my property upon my request?
4. Can I see the results of the testing you've done on my property?
5. Can I see the results of testing you've done on other properties in the neighborhood?
6. I'm moving into the area; can I see the results of sampling that's been done?
7. Who will be doing the sampling?
8. How can we be sure the sampling data is accurate?
9. Can you guarantee the accuracy of sampling results?
10. How can we be sure that future sampling won't find things that you didn't find now?
11. What is the worst-case scenario?
12. Where else has this happened?
13. Where can I get more information about similar sites that have already been cleaned up?
14. Can damages be reversed?
15. What is the evidence that my drinking water is contaminated or my yard has contaminated soil?
16. Why hasn't my well or home been sampled?

## Health Questions

1. Am I at risk from the contamination?
2. What are my past exposures?
3. How could I have been exposed?
4. What are the risks to my children?
5. I'm pregnant (or planning to be). Will the contaminants affect my unborn child?
6. What health effects can I expect to see if I've been exposed to site contaminants?
7. Have any health problems been reported so far?
8. How many people have become ill as a result of the site?
9. Does this explain why _____ is sick?
10. I have a recent health problem (i.e., headaches, rashes, etc.) that I never had before; could the site contamination have caused this problem?

11. What does my doctor know about this?
12. Is my doctor qualified?
13. Is there any medical person I can talk to about what I am experiencing to see if it is related to the contamination I may have been exposed to?
14. Will EPA pay my medical bills? (*EPA cannot pay medical bills. It is suggested that you contact your local health department for information on how you may be able to get assistance.*)
15. Can you set up a temporary, local health center or clinic where we can be tested?
16. Where can I go to learn more about the risk from the site?
17. What are the short-term effects?
18. What are the long-term effects?
19. Can you guarantee we won't get cancer in 30 years?
20. What is the risk of dying from cancer?
21. Are you going to test residents for exposure?
22. Can we drink the water/breathe the air?
23. Is it safe to bathe or shower in the water?
24. Is it safe to water our lawns with the potentially contaminated water?
25. Is it safe to mow our lawns if the soil underneath is potentially contaminated?
26. Can I eat food from my garden?
27. Will you provide us with bottled water?
28. Why have some people received bottled water and not others?
29. What are the impacts to natural habitat (i.e., fish and other species)?
30. Is it safe to use the river for fishing and other recreational purposes?
31. How do you know whether it's safe to go fishing?
32. Is it safe to eat the fish?
33. Can my children play outside?
34. What are the risks to my pets?
35. Why is EPA wearing protective clothing and we are not?
36. What can I do to protect myself and my family?
37. What's being done right now to protect my health and the health of my family?
38. Will capping the site protect my health?
39. What happens if my ventilation system shuts down?
40. What is the ATSDR?
41. What is a Public Health Assessment?
42. How do we get rid of the risk?

## Cleanup Concerns

1. How exactly are you going to clean up the site? Why was this particular cleanup method chosen over other options?
2. What process was used (or will be used) to select contractors to perform the cleanup?
3. How will cleanup performance be monitored or evaluated?
4. How much will the cleanup cost?
5. Who will pay for the cleanup?
6. Why not dig up the contamination?
7. Why are you going to just "cap" everything and leave the contamination there?
8. Is dredging safe?
9. Won't dredging just stir up things and contaminate the water even more?
10. How will my quality of life be affected during the cleanup (i.e., noise, traffic, odors, etc.)?
11. After you finish the cleanup, then what? (what happens next?)
12. After the cleanup, will you continue to test to make sure it's still working?

## Superfund Process Questions

1. Do you have enough money to cover the cleanup costs?
2. What if you don't have the funds to finish the job?
3. What if you discover the cleanup is going to cost more than estimated, what happens then?
4. Why aren't you cleaning up the entire site?
5. Why don't you clean up all of the contamination, instead of allowing some to remain?
6. Who determines what levels of contamination are considered safe?
7. Is there someone local residents can talk to if we have questions or concerns?
8. How will you pay?
9. Will my tax dollars be used to address this problem that someone else caused?
10. What is a PRP?
11. Who can we sue?
12. Are our local officials aware?
13. Will we be compensated?
14. What guarantees the cleanup is effective?
15. How will you know when everything is clean?
16. Can you guarantee that all of the contamination will be removed?
17. What if the cleanup doesn't work?
18. What happens if my water (or soil, etc.) is still contaminated after the cleanup?
19. Who's in charge?
20. Who makes the final decision?
21. How/why a Superfund Site?
22. Why does EPA study a site to death? Why don't they just get in there and clean it up?
23. What is the process to come to a solution?
24. Can you guarantee you won't damage our house?
25. Can we get jobs helping with the cleanup?
26. Has an EPA decision ever been reversed?
27. There's another site down the road; can you tell me what's going on there?
28. How does a homeowner know if EPA has investigated pollution problems on their property?
29. Will EPA release specific addresses at which samples have been taken?
30. If we can't eat the fish anymore because of health risks, can you give us a food subsidy?

## Communication Concerns

1. How will you communicate information to me?
2. How will I be informed of what's going on?
3. What happens if you find high concentrations of contaminants near my home—how will I know?
4. Will you share the testing data with residents?
5. Will you let us know if something unexpected happens during the cleanup and things get worse?
6. If a cleanup plan is selected that residents disagree with, is there an appeal process?
7. How will you address public comments?
8. Will you address ALL of the public comments?
9. How do you decide which comments NOT to address?
10. Does a database exist that shows contaminated areas? For example, can I type in an address and find out if there is anything within a 5-mile radius that is being cleaned up or has been cleaned up by EPA or the state?

## Relocation/Buyout Questions

1. Will you relocate me?
2. Will the government buy me out?
3. What is EPA going to do?

4. Why did you let this happen?
5. Will you move me or buy my home?
6. Should I move or relocate?
7. I was told residents might have to relocate during the site cleanup. Who will pay for my moving costs? What about other expenses I may be forced to incur (i.e., costs of transporting my children to school because they won't be able to take the bus, or daily food costs because I won't have access to my stove and refrigerator, etc.)?

## Property Values, Owner Liability, Buying or Selling Property, Takings

1. How will this affect my property value?
2. My property value has decreased because of the site contamination problem. Will I be compensated for this?
3. What can citizens do if their property value goes down because of a polluted (Superfund) site?
4. The site has placed a negative stigma on our community that may affect potential investors, developers, or homeowners; what will be done about this?
5. Will there be an immediate appraisal of my property to adjust my tax status?
6. Do property values rebound? How long will it take? Can you provide examples?
7. Can I be held responsible for pollution on my residential property?
8. If my property sits on a contaminated aquifer, am I liable?
9. As a prospective purchaser of a piece of property that is on or near a Superfund site, what would my responsibility be for contamination that existed at the time of purchase?
10. Is a bank or other lender liable for contamination if it lends money (or has lent money) to owners or developers of contaminated property?
11. What information can EPA provide to potential buyers?
12. Do I have to disclose the contamination on my property to potential buyers?
13. If my loan is denied because of concerns about contamination, can EPA call my bank or appraiser?
14. Will I be able to refinance my loan due to the devaluation of my property?
15. Can I refuse to limit EPA access to my property? If EPA uses my property for sampling or well installation, will I be paid?
16. Can EPA take part or all of my property? How long can they keep me away from my property?
17. Can a homeowner perform a cleanup to ensure that he/she will be able to sell their property?
18. Will this keep our community from developing?
19. If soil is excavated from my yard, will I receive financial assistance to replace plants and shrubbery?

## Challenge Questions

1. Is it the fault of the state or city or another Federal agency?
2. Why have we been ignored?
3. How could this have been avoided?
4. How can you sleep when our children are dying?
5. Why does EPA cover up its actions?
6. Why won't you share all the information?
7. Would you live here?
8. Why are you here?
9. Why did it take you so long to tell us about the contamination?
10. When you first discovered there MIGHT be a problem, why didn't you tell us then?
11. Why can't you clean it up right away?
12. Why should we trust you? How can I trust what you're telling me about the site? How can I trust what you're telling me about my safety?
13. Who's to blame?
14. You would not do this in a white neighborhood, why do it here?

15. Would you live in my house?
16. What are your qualifications for handling this type of cleanup?
17. Do comments from community members really make a difference, or has EPA already made the decision and this is just an exercise they have to go through?
18. I'm concerned that cost will be the driving force behind the agency's selected cleanup option; does community opinion really matter?
19. If the majority of residents disagree with how EPA [or other agency] is planning to clean up the site, will EPA [or other agency] change its mind?
20. Why do you care?
21. Why pays you?
22. Are you being paid off?
23. Do YOU agree with the science?
24. Do you agree with the decision?
25. Are you telling the truth?
26. Is it EPA's official position that we are safe?
27. Why did EPA allow this to happen?
28. Why have you been covering this up for years?
29. Who can give me answers if you can't?
30. Where can I get more information about this site?
31. Did EPA allow the company to operate because you are on the take?

*This list of frequently asked questions is a modified version of frequently asked questions derived by a workgroup of Community Involvement Coordinators in the U.S. EPA Superfund Program, and questions developed by Vincent T. Covello, Ph.D., Center for Risk Communication, August 2008.

# Attachment 3: Layout of a Message Map and Example

A message map should be completed for every important stakeholder question. The top level of the message map identifies the audience and the question or concern that the map is intended to address. The second level of the template contains three key messages that answer the question or concern. The last section contains supporting information that amplifies the key messages. This information also provides additional facts or details (EPA 2007).

| Question |
|---|
| Audience/Stakeholder: |
| "Core" Concern: |
| |
| Key Message #1 (most important)<br>▪ Supporting information<br>▪ Supporting information<br>▪ Supporting information |
| Key Message #2<br>▪ Supporting information<br>▪ Supporting information<br>▪ Supporting information |
| Key Message #3<br>▪ Supporting information<br>▪ Supporting information<br>▪ Supporting information |

**Example: Credible threat involving chemical contamination of a water reservoir:**

| Should people be worried about the drinking water? |
|---|
| Audience/Stakeholder: Public/Media |
| "Core" Concern: Human health, trust in government |
| |
| **We are concerned about any threat to our drinking water systems**<br><br>▪ We are working closely with public health authorities and others to minimize any potential harm.<br>▪ We have experts on staff trained to respond to events such as this.<br>▪ We are using all available resources to protect public health. |
| **We are testing the water for the presence of {insert chemical name}**<br><br>▪ We are testing the water in the reservoir and all associated distribution points.<br>▪ We have highly qualified people taking samples.<br>▪ We are following testing procedures recommended by the U.S. Environmental Protection Agency. |
| **We ask you to be alert and stay tuned for updates**<br><br>▪ People should call {insert phone number} or go to {insert website} for information and updates.<br>▪ People should stay tuned to local radio or television.<br>▪ Until we know more, people in the impacted area {insert area} should use an alternative supply of water. |

* U.S. Environmental Protection Agency (EPA). 2007. Risk Communication in Action: The Tools of Message Mapping. Office of Research and Development, Cincinnati, OH. EPA/625/R-06/012, August, 51pp.

# Attachment 4: The Four Steps to Indexing

Indexing techniques are powerful tools to communicate complex information. All of us are familiar with many indices that are used in daily life: the various economic indices, such as the consumer price index, the stock market indices, and others. Most of these tools compress complicated multivariate analyses into a single number. With respect to the environment, there are air-quality indices, water-quality indices, a fish-quality index, an urban-sprawl risk index, a heat index, and a host of others. If you are routinely asked to explain complicated information, developing an index might be an excellent tool for communicating information that is difficult to explain.

## Step 1

Identify the potential subject of the index and the metric that captures the risk(s) or benefit(s). For a water-quality index, the subject is water and the risk-related metric might be the concentration of a chemical or biological contaminant.

## Step 2

Measure the potential range of the risk- or benefit-related metrics. If the range is potentially huge, such as the case with a biologic agent like bacteria, this range may need to be compressed. For bacteria, which could range from one to ten billion quite easily, that range will be difficult to communicate since people don't readily understand such large numbers. One way to compress these ranges is to use the logarithm of the number, so that the range mentioned previously (one to ten billion) becomes zero to ten. If you wished, you could take the log and multiply it by ten to give you a range from 0-100. These scales, like 1-5, 1-10, or 1-100, are the easiest for people to understand.

## Step 3

Assign risk (benefit) ranges. This could establish simple safe/not-safe ranges, where there is a cut-off for when risk falls below some safety threshold. If there are ranges to risk (or benefit) the range of potential values of the index could be subdivided further. You could use a three-tier system like good, bad, and ugly, or a five-tier system of good, moderate, unhealthy, very unhealthy, and hazardous. The choice of how many tiers to use depends mostly on whether you need to communicate safe or unsafe, or whether there are big ranges of risk values that demand a finer shading of risk.

## Step 4

Color-coding and iconizing. These tools put a user-friendly public face to the index. For a two-tier system, red (for bad) and green (for good) might be sufficient; for a three-tier system, the stoplight metaphor works well (green for good, red for bad, yellow for in-between). For a five-tier system, a variation on the stoplight that uses orange for the range between red and yellow, and chartreuse for the range between green and yellow, works well. People don't understand the visible-light color spectrum and using that metaphor (where blue is better than green) confuses people (just think about the terrorist threat index, where blue is the good range). For icons, you can use the outline of the subject. For example, a heat index might use a stylized thermometer icon. An air-quality index might use a color-coded cloud, for example.

Some examples for creating a risk index could be:

- Bottled Water Quality Index
- Restaurant Quality Index
- Turkey Quality Index
- Leaf Color Index
- Wine Index

*From Risk Communication in Action: The Risk Communication Workbook. U.S. Environmental Protection Agency EPA-625-R-05-003. August 2007, 75 pp.

# Attachment 5: Non-Judgmental Language – Helpful Phrases

| Instead of saying/thinking: | Consider saying/thinking: |
|---|---|
| That's ridiculous<br>That's unreasonable | I hadn't considered that, how will that work for both of us?<br>I don't understand how that will work.<br>What makes that a fair solution? |
| That doesn't make sense<br>You're not making sense | I'm not following you…<br>Help me understand…<br>I don't understand, how will that work? |
| That's not workable<br>That will never work | I'm not comfortable with that because…<br>That's one option, here are my concerns…<br>I'd like to hear your thinking on how this would work |
| You aren't doing this right<br>You didn't do this right | This is different than what I expected<br>Does this way of doing it still meet the requirements? |
| We're not going anywhere<br>If only you would stop…<br>We'll never agree | It seems as though ____ may be getting in our way<br>I think we can find a solution<br>Let's look at we have accomplished so far |
| Why do you want X? | How did you get to X?<br>What makes you want X?<br>What makes X a good solution/choice? |
| Why did you do that? | What motivated you to do that? |
| That has nothing to do with this | How does that relate to this? |
| The fact is…<br><br>This is how it is: | Correct me if I'm wrong, I understand (state facts as you see them)<br>The way I see it is… |
| I won't do X | I am not comfortable doing X<br>X makes me nervous (etc.) because… |
| Yes, but… | Yes, and… |
| You haven't done X | I appreciate your willingness to do X…we are ___with completing it? |
| You're wrong | My experience has been…<br>I see this differently…<br>I need to understand…better |
| Do X<br>You should do X | I need help with X<br>We need to get X done…what suggestions do you have?<br>I'd like you to do X, will that work?<br>Can you do X?<br>Are you willing to do X? |
| I want X<br><br>I must have X | One option I see is X…how does X work for you?<br>One way I see to resolve this is X…what do you think of X?<br>One option is X…X is important to me because… |
| We have nothing in common | We agree on… |
| You're lying. I don't believe that. | I'm confused about… |
| You said…<br><br>But you did… | Let me see if I have this right, you are saying…<br>I'm not clear about…<br>Let's focus on the future |
| That's not fair | Let's find a solution that is fair for both of us |

| Instead of saying/thinking: | Consider saying/thinking: |
|---|---|
| You make me mad<br>You're making me feel | I get upset when…<br>I feel… |
| I…You… | We… |

**Remember – TONE and BODY LANGUAGE make all the difference in any communication.**

U.S. Institute for Environmental Conflict Resolution. 2010. *Non-Judgmental Language: Helpful Phrases* [Handout]. Training Workshop on Introduction to Managing Environmental Conflict, Washington, D.C. September 14-15.

# Attachment 6: Useful Terms and Definitions for Explaining Risk

*This document was developed for OSWER staff who interface with communities. The definitions included here are not official Agency definitions and this information is not intended to be a standalone document. Instead, we envision staff would adopt definitions in this document to meet their communication needs (e.g., on fact sheets, in risk communication conversations, and other communication methods). The goal of creating this document is to aid field staff in their risk communication efforts and continually build community capacity to engage with EPA.*

*The term "contaminant" is consistently used throughout the document to mean hazardous substances, pollutants, pollution, and chemicals, unless a legal definition uses another term.

**Acute:** Occurring over a short period of time.

**Acute Exposure:** Exposure to a contaminant within a short time period (24 hours to a few days). During acute exposures, which may occur as a result of an accident or emergency, contaminant concentrations are typically higher than during regular or continuous exposures.

**Acute Risk:** Health risks associated with exposure to a contaminant within a short time period (acute exposure). Acute risk typically occurs in occupational settings where workers are using chemicals as part of their job. Health effects are often reversible. However, exposure may also result in harmful effects to major organs, depending upon the contaminant and its concentration.

**Acute Toxicity:** The ability of a contaminant to cause harmful health effects (sometimes death) soon after exposure within a short time period.

**Acceptable Exposure Level:** This is a legal term defined in the National Contingency Plan (NCP), which is the regulation that promulgates CERCLA (see below for definition). An acceptable exposure level is the "concentration level of a contaminant to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime..." For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent lifetime cancer risk to an individual of between $10^{-4}$ (1 in 10,000) and $10^{-6}$ (1 in 1,000,000) using information on the relationship between the dose and response. The $10^{-6}$ risk level shall be used as the point of departure for determining remediation goals for alternatives when Applicable or Relevant and Appropriate Requirements (ARARs) are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure." Sometimes this is referred to as the acceptable risk range (Source: National Oil and Hazardous Substances Pollution Contingency Plan).

Sometimes "acceptable exposure level" is referred to as "acceptable risk."

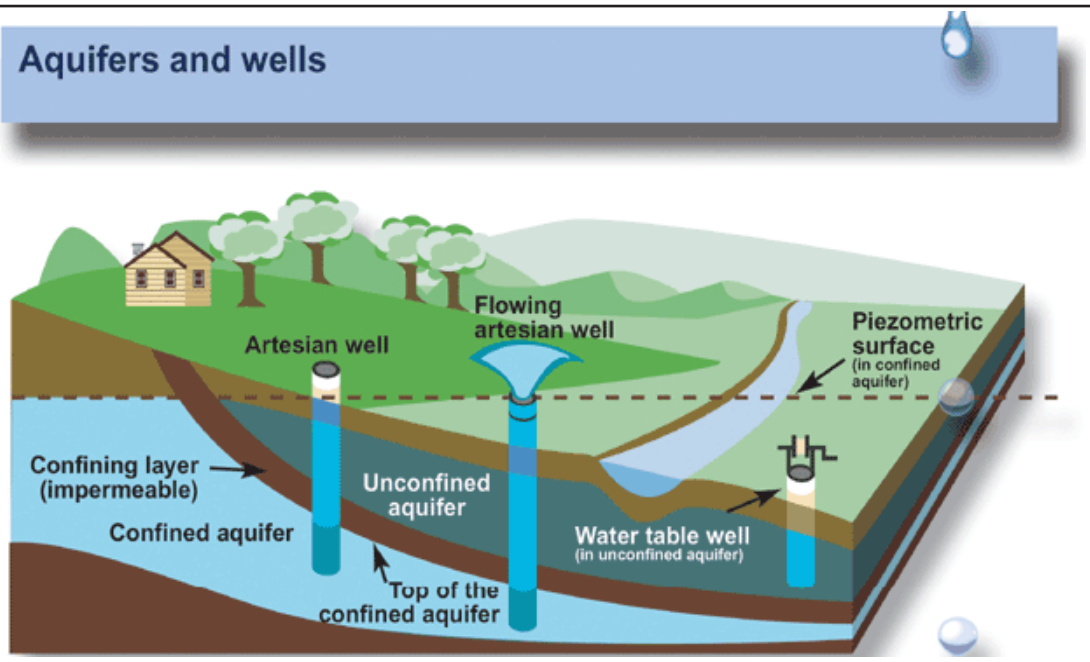
*Alternative definition: An "acceptable" risk level (or range) of a contaminant, defined by law, that EPA uses to make cleanup decisions at Superfund sites. This is a risk level (or range) that people can be exposed to, including sensitive populations, without health problems. For carcinogens, the acceptable risk range is between $10^{-4}$ (1 in 10,000) and $10^{-6}$ (1 in 1,000,000).*

**Additive Risk Assessment:** A process that considers the aggregate (i.e., additive) ecologic or health risk to a target organ caused by the accumulation of risk from multiple stressors (any physical, chemical, or biological entity that can induce a harmful response) and multiple pathways of exposure.

**Adverse/Harmful Health Effect:** A change in body function (e.g., organ function or cell structure) that might lead to disease or health problems.

**All Appropriate Inquiry (AAI):** A process for the Brownfields Program of evaluating a property's environmental conditions and assessing the likelihood of any contamination. It is required for those purchasing or acquiring property to assert a defense against CERCLA liability and must comply with ASTM E-1527-05. A Phase I Environmental Site Assessment (ESA) examines historical property records, interviews neighbors, and includes a site inspection but doesn't generally include sampling. Phase II ESA and subsequent phases involve soil sampling and data analysis.

**Aquifer:** An underground geological formation, or group of formations, containing water. Aquifers are sources of groundwater for wells and springs.




The attributes of an aquifer.

Source: Environment Canada

**Asbestosis:** A disease associated with inhalation of asbestos fibers. The disease makes breathing progressively more difficult and can be fatal.

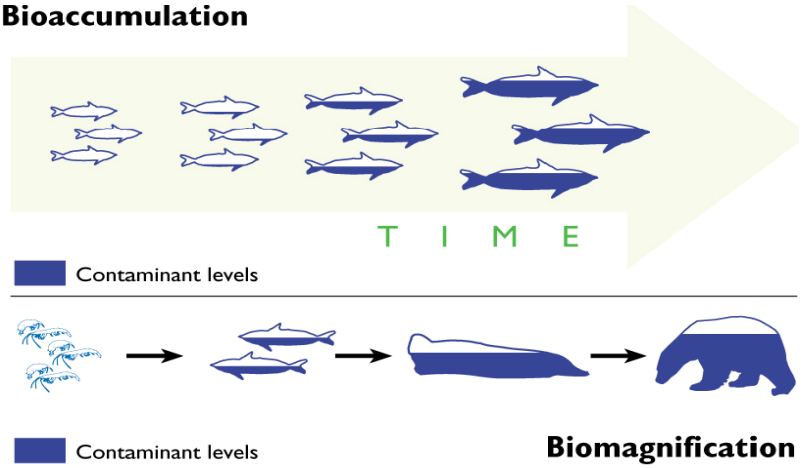
**Background:** According to EPA Guidance, "refers to constituents or locations that are not influenced by the releases from a site, and is usually described as naturally occurring or anthropogenic: 1) Anthropogenic – natural and human-made substances present in the environment as a result of human activities (not specifically related to the CERCLA release in question); and 2) Naturally occurring – substances present in the environment in forms that have not been influenced by human activity" (Source: Role of Background in the CERCLA Cleanup Program, 2002).

*Alternative definition: Contamination that is not influenced by the site and may occur naturally (e.g., arsenic in soil and water) or is present in the environment as a result of human activities unrelated to the site (e.g., arsenic from pesticide applications).*

*Alternative explanation: You can find contaminants everywhere. Many of the same contaminants that are part of a Superfund site may not be influenced by the site. Therefore, EPA collects samples in areas that are uncontaminated by the site to determine local background concentrations.*

**Bioaccumulation:** A process in which contaminants are retained in an organism's body and increase in concentration over time because the substance is very slowly metabolized or excreted. For example, fish accumulate methylmercury in muscle over time; therefore, older fish have higher concentrations of methylmercury in their muscle tissues.

**Bioavailability:** The amount of a contaminant that is absorbed into the body following skin contact, ingestion, or inhalation. The less bioavailable the contaminant, the less toxic its effects are on an organism. For example, when people ingest vitamins, only a portion of the ingested dose is absorbed into the body; the rest passes through the body.




Bioamplification, Bioaccumulation and Bioconcentration. Reprinted on http://mercurypolicy.scripts.mit.edu/blog/?p=499.

Source: Mercurypolicy.scrips.mit.edu

**Bioconcentration:** The accumulation of a chemical in tissues of a fish or other organism to levels greater than in the surrounding aquatic environment. For example, fish accumulate methylmercury in muscle at higher levels than the methylmercury levels in water they live in.

**Biologically Effective Dose:** The amount of a contaminant in the body reaching the cells or target organs where a harmful health effect occurs.

**Biomagnification:** The increase in concentration of a contaminant in the tissue of organisms higher in the natural food chain (i.e., predator-prey associations), primarily through the mechanism of dietary accumulation. For example, a shark will accumulate methylmercury over time at higher concentrations than the fish they eat.

**Brownfields:** Real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. A brownfield, by statute, cannot be a Superfund site, a Federal facility, or have ongoing active enforcement actions. Common brownfield examples include abandoned gas stations or low-risk petroleum contaminated sites, areas of mine-scarred land, clandestine drug labs or older residential, commercial, or industrial properties where contaminants are known to be present or suspected to be found. EPA's Brownfields Program provides direct funding for brownfields assessment, cleanup, revolving loan funds, and environmental workforce development and job training; collaborates with other EPA programs, other federal partners, and state agencies to identify and make available resources for brownfields activities; and provides technical information on brownfields financing matters.

**Carcinogen:** Any contaminant that can cause cancer.

**Carcinogenesis:** The origin or production of a benign or a malignant tumor.

**CERCLA:** Comprehensive Environmental Response, Compensation, and Liability Act. According to EPA guidance, "The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA, or "Superfund"), establishes a national program for responding to releases of hazardous substances into the environment" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

*Alternative definition: The law passed by Congress that established the Superfund program.*

**Chronic:** Occurring over a long period of time.

**Chronic Exposure:** Exposure to a contaminant that occurs over a long period of time, or a significant fraction of the individual's lifetime (usually seven years to a lifetime).

**Chronic Risk:** Long-term health risk. Chronic risk usually occurs at lower doses and may occur in residential or commercial (e.g., office) settings. Health effects associated with chronic exposures may not become apparent for many years.

**Chronic Toxicity:** The ability of a contaminant to cause harmful health effects resulting from long-term (chronic) exposure.

**Cohort:** In epidemiology (study of the disease in human populations), a group of people sharing one or more characteristics. A birth cohort consists of all persons born within a certain time period, usually a year. A group of people exposed to similar levels of a contaminant during a similar period is a cohort.

**Cohort Study:** An epidemiologic (human population) study that follows subjects in different exposure groups (exposed versus no exposure) and compares the difference in disease rate or incidence of symptoms. Although study subjects ordinarily are followed over time, a cohort study can sometimes be carried out retrospectively, using historical data.

**Congenital:** Existing at birth (particularly birth deformities or anomalies). Congenital anomalies may originate from genetic, infectious, or environmental origins, although in most cases, it is difficult to identify their cause.

**Contaminant:** According to EPA regulations, "any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation in to any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring. The term does not include petroleum…" (Source: National Oil and Hazardous Substances Pollution Contingency Plan).

*Alternative definition: Any physical, chemical, biological, or radiological substance or matter found in air, water, soil, or biological matter that has a harmful effect on human health or the environment.*

**Contaminant of Concern (COC):** A site-related contaminant that EPA has determined, at the conclusion of a baseline risk assessment, to pose an unacceptable risk to human health and/or the environment. In the Superfund program, COCs are the drivers of (i.e., determine) cleanup actions on the site evaluated in a feasibility study.

**Contaminant of Potential Concern (COPCs):** Also called "chemicals of potential concern" in EPA guidance, are defined as "chemicals that are potentially site-related and where data are sufficient quality for use in the quantitative risk assessment" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

*Alternative definition: A potentially site-related contaminant that has been shown through scientific research to pose possible harmful effects to human health or the environment. In the Superfund program, a thorough remedial investigation investigates all COPCs to determine which ones rise to be COCs.*

**Cumulative Risk Assessment:** According to EPA guidelines, an analysis, characterization and possible quantification of the combined risks to health and/or the environment from multiple agents or stressors (including non-chemical stressors and the concepts of individual or population vulnerability) (Source: EPA Framework on Cumulative Risk Assessment, 2003).

*Alternative definition: An examination of the combined harmful effects on human health or the environment from multiple stressors, including biological, chemical, and physical factors, such as individual health status.*

**Developmental Toxicity:** Structural abnormality, altered growth, functional deficiency, death, or other harmful health effect that may be a result of exposure to contaminants prior to conception (in either parent), during prenatal development, or after birth up to the time of sexual maturation.

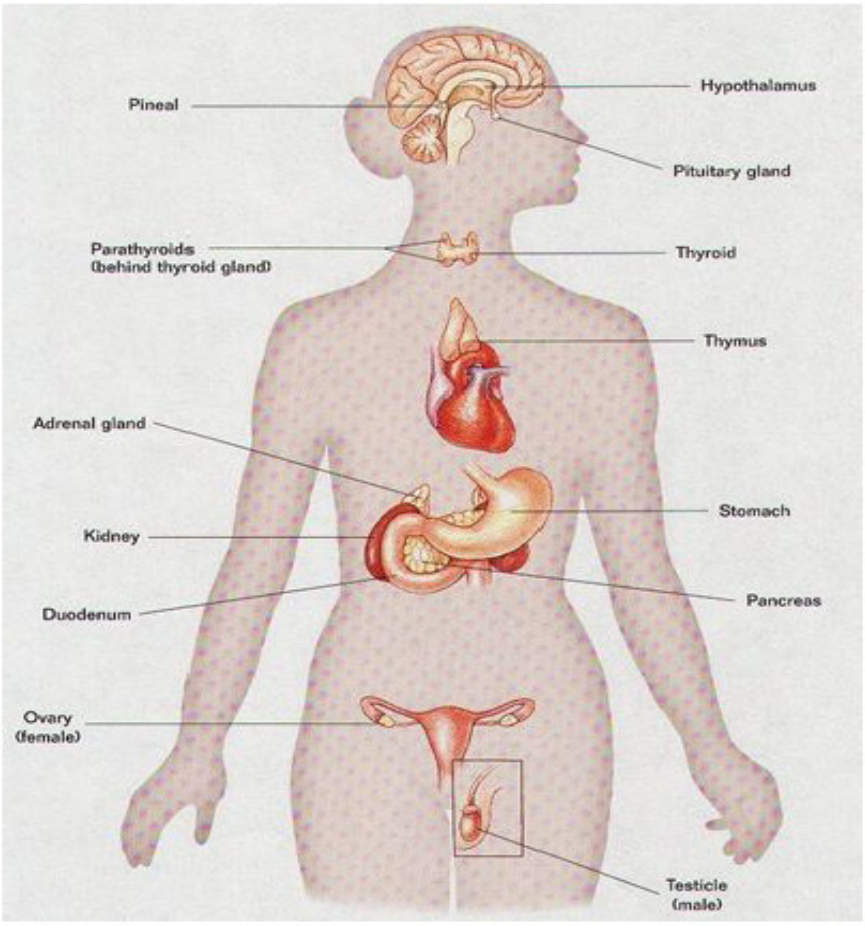
**Dose:** The amount of a contaminant an organism is exposed to (e.g., through ingestion or inhalation) over a period of time.

- An "**exposure dose**" is the amount of a contaminant that is encountered in the environment.
- An "**absorbed dose**," according to EPA guidance, is "the amount of a substance penetrating the exchange boundaries of an organism after contact. Absorbed dose is calculated from the intake and the absorption efficiency. It is usually expressed as mass of a substance absorbed into the body weight per unit time (e.g., mg/kg-day)" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).
- An "**effective dose**" is the contaminant concentration present at the site(s) of toxic action (e.g., specific organ) and which is responsible for causing an adverse effect.

**Dose Response Relationship:** The measurable relationship between exposure to a contaminant and the harmful health effect. The severity of the health effect shifts as the amount of exposure to the contaminant changes. For example, a small dose of carbon monoxide may cause drowsiness; a large dose can be deadly.

**Ecology:** The study of the relationship of living things to one another and their environment

**Endocrine Disruptors:** Synthetic chemicals that disrupt normal endocrine system functions in humans and wildlife by blocking or mimicking hormones (e.g., PCBs, dioxins). The endocrine system is made up of glands located throughout the body. Hormones are made by the glands and released into the bloodstream or the fluid surrounding cells; receptors in various organs and tissues recognize and respond to hormones.




The human endocrine system.

**Endpoint:** An observable health effect (e.g., a certain concentration of a contaminant causing liver damage).

**Epidemiology:** Study of the distribution of disease, or other health-related events in human populations.

**Excess Cancer Risk:** The additional risk of cancer from exposure to a contaminant beyond an individual's risk of cancer from everyday life. Excess cancer risk is described in terms of the probability that an exposed individual will develop cancer because of that exposure by age 70. At a Superfund site, excess cancer risks are summed across all contaminants of concern, or COCs, and exposure pathways that contribute to exposure. In general, EPA considers excess cancer risks that are below about 1 chance in 1,000,000 ($1\times10^{-6}$ or 1E-06) to be so small as to be negligible, and risks above 1 in 1,000 ($1\times10^{-4}$ or 1E-04) to be sufficiently large that some sort of remediation is desirable. Excess cancer risks that range between 1E-06 and 1E-04 are generally considered to be "acceptable".

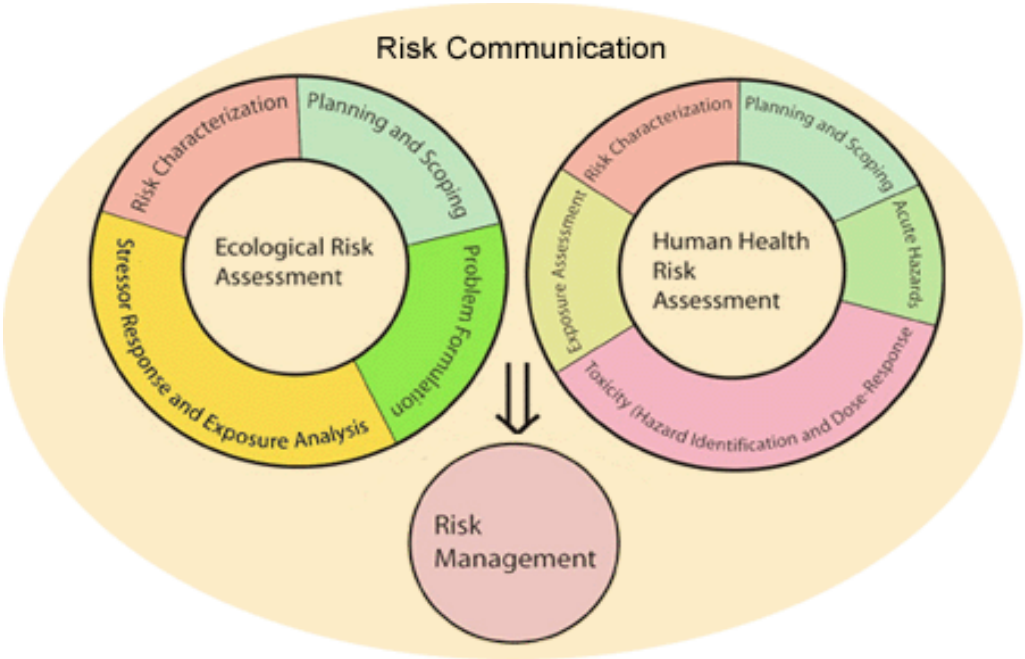
*Alternative definition: The probability that an individual will contract cancer over a lifetime above and beyond the probability of the general population.*

**Exposure:** According to EPA guidance, "contact of an organism with a chemical or physical agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, gut) and available for absorption" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

*Alternative definition: Contact with a contaminant by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term (acute) or long-term (chronic).*

**Exposure Assessment:** According to EPA guidance, "the determination or estimation (qualitative or quantitative) of the magnitude, frequency, duration, and route of exposure" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

*Alternative definition: The process of finding out how people come into contact with contaminants; how often and for how long; and how much they are in contact with.*




Exposure assessments are components of the Superfund human health risk assessment process. Risk assessments may proceed in a straightforward, linear fashion, but often repeat stages depending on sampling and analytical results and on decisions made by risk assessors and risk managers.

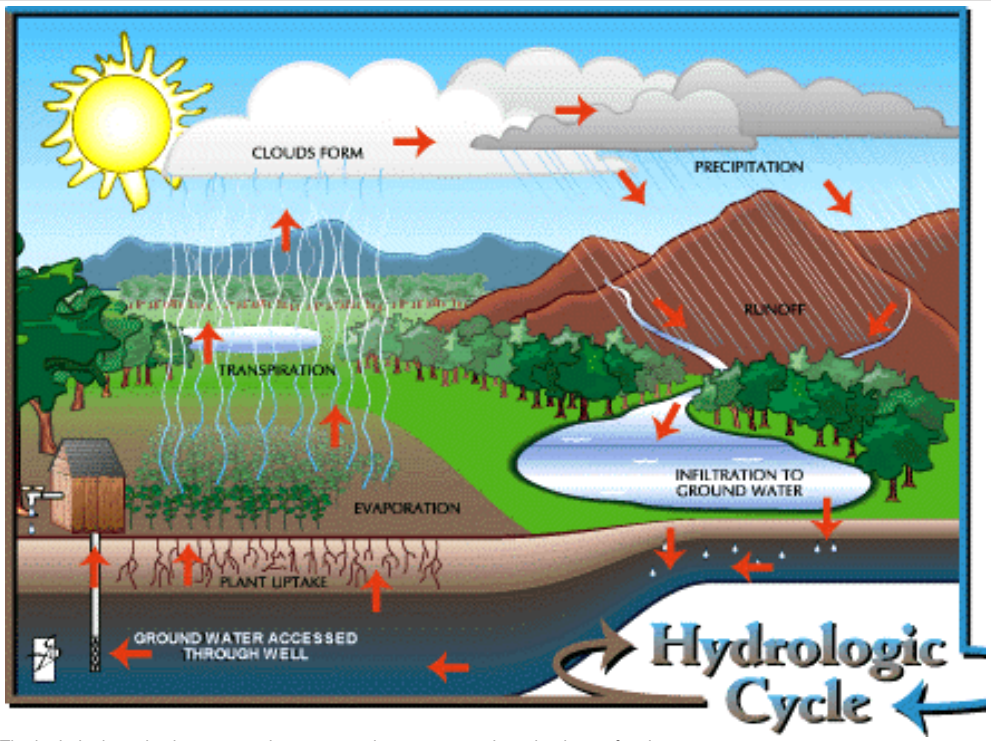
Source: EPA Superfund Program

**Exposure Route:** The way a contaminant comes in contact with an organism (i.e., by ingestion, inhalation, or skin contact). For example, a person may become exposed to lead in paint through eating paint chips (ingestion), inhaling dust contaminated with paint (inhalation), or having paint on their skin (dermal contact).

**Federal Facility:** Any building, installation, structure, land, public work, equipment, aircraft, vessel, or other vehicle and property, owned by, or constructed or manufactured for the purpose of leasing to, the federal government.

**Fence Line Property:** Property located at the property boundary of another (e.g., a house next to a Superfund site).

**Groundwater:** Fresh water found beneath the earth's surface, usually in aquifers, which supply wells and springs.




The hydrologic cycle shows groundwater extraction sources and mechanisms of recharge.

Source: EPA

**Hazard Ranking System (HRS):** The principal screening tool used by EPA's Superfund program to evaluate risks to public health and the environment associated with abandoned or uncontrolled hazardous waste sites. HRS calculates a score based on the potential of hazardous substances spreading from the site through the air, surface water, or groundwater, and on other factors such as density and proximity of human populations. This score is one of the factors used in deciding if the site should be listed on the National Priorities List.

**Hazardous Waste:** A subset of solid wastes that can pose a substantial or potential hazard to human health or the environment, and meet any of the following criteria: 1) specifically listed as a hazardous waste by EPA's Resource Conservation and Recovery Act (RCRA) program; 2) generated by the treatment of hazardous waste or is contained in a hazardous waste; or 3) exhibits at least one of four characteristics: ignitability, corrosivity, reactivity, or toxicity.

**Health Advisory:** An EPA document that provides guidance and information on contaminants that can affect human health and that may occur in drinking water. According to EPA guidance, "health advisory values are concentrations of contaminants in drinking water at which harmful health effects would not be expected to occur for an exposure of the specified duration" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

**Hot Spot:** According to EPA guidance, "an area of very high contaminant concentrations relative to other areas of the site" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

**Incidence:** The number of new cases of a disease (or health condition) that develop within a specified population over a specified period of time (i.e., the rate of occurrence of a disease or health condition). For example, the incidence rate of lung cancer in the USA is typically expressed as the number of cases per 100,000 people per year.

**Institutional Controls:** Legal and administrative tools to minimize exposure to contaminants and/or protect the integrity of a response action in order to protect human health and the environment (e.g., zoning, notices and warnings, easements, and restrictive covenants).

**Malignant:** Describing a tumor that produces cells that can migrate to new sites in the body where additional tumors can subsequently develop.

**Maximum Contaminant Level (MCL):** Maximum level of a contaminant in drinking water delivered to any user of a public water system allowed by EPA. MCLs are enforceable. EPA sets MCLs at levels that are economically and technologically feasible. Sometimes state MCLs are stricter than EPA's.

**Maximum Contaminant Level Goal (MCLG):** A non-enforceable level of a contaminant in drinking water, set at the level at which no known or anticipated harmful effects on human health occur. MCLGs are ideal, health-based goals which are set in the National Primary Drinking Water Standards developed by EPA and are usually the starting point for determining the regulated Maximum Contaminant Level. For chemicals believed to cause cancer, the MCLGs are set at zero.

**Metastasis:** The spread of cancer from one part of the body to another. For example, a secondary growth of a tumor at a part of the body distant from the primary tumor.

**Mitigation:** Actions taken to lessen the actual or foreseen negative environmental impact of a project or activity.

**Mg/Kg (milligrams per kilogram):** A unit of measure commonly used to report concentrations of a contaminant. A concentration of 1 mg/kg is equal to 1 part per million (ppm). For example, a concentration of arsenic in the soil is 15 mg/kg, or 15 milligrams of arsenic per kilogram of soil.

**National Contingency Plan (NCP):** The National Oil and Hazardous Substances Pollution Contingency Plan, more commonly called the National Contingency Plan, or NCP, is the federal government's blueprint for responding to both oil spills and hazardous substance releases. According to EPA guidance, "the National Oil and Hazardous Substances Pollution Contingency Plan is the regulation that implements CERCLA. Among other things, the NCP establishes the overall approach for determining appropriate remedial actions at Superfund sites" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

*Alternative definition: The regulation developed by federal agencies to implement CERCLA and respond to oil spills and hazardous substance releases to the environment.*

**National Priorities List (NPL):** EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under CERCLA, or the Superfund Program. Sites listed on the NPL are typically referred to as Superfund sites.

**Naturally Occurring Background Levels:** According to EPA guidance, "ambient concentrations of chemicals that are present in the environment and have not been influenced by humans (e.g., aluminum, manganese)" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

*Alternative definition: Concentrations of contaminants in the environment that occur naturally. For example, arsenic occurs naturally in soil and minerals and it is possible to ingest small amounts of naturally occurring arsenic in food and water.*

**Polycyclic Aromatic Hydrocarbon (PAH):** PAHs are a group of more than 100 organic chemicals found naturally in crude oil and coal, and in their products, including diesel, jet fuel, asphalt, and coal tar. They enter the environment mostly as releases to air from volcanoes, forest fires, residential wood burning, and exhaust from automobiles and trucks. PAHs also can form during incomplete combustion of fossil fuels, garbage, or other organic substances like tobacco or charbroiled meat. A few PAHs are used in medicines and to make dyes, plastics, and pesticides.

**Parts per Million (ppm):** A unit of measure commonly used to report very small amounts of a contaminant. 1 ppm is equal to 1 mg/L (1 milligram of that contaminant in a liter of liquid media); 1 ppm is also equal to 1 mg/kg (1 milligram of the contaminant in kilogram of solid media).

1 part per million (ppm) is equivalent to:

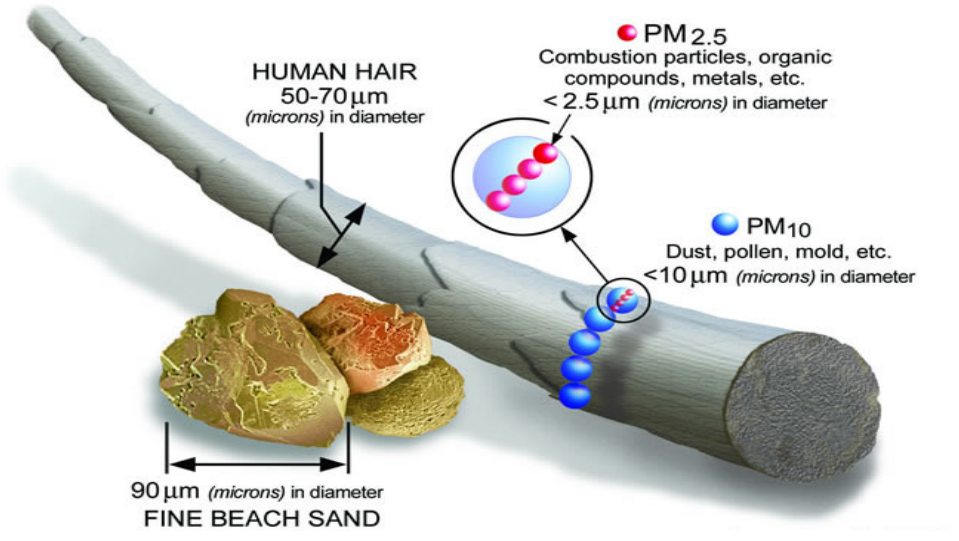
- 1 milligram in a kilogram (mg/kg)
- 1 inch in 16 miles
- 1 minute in 2 years
- 4 drops of ink in 55 gallons of water

**Parts per Billion (ppb):** A unit of measure commonly used to report extremely small amounts of a contaminant; 1 ppb is equal to 1 µg/L (1 microgram of that contaminant in a liter of liquid media) or 1 µg/kg (1 microgram of that contaminant in a kilogram of solid media); 1 ppb is also equal to 1,000 parts per million.

1 part per billion (ppb) is equivalent to:

- 1 microgram in a kilogram (µg/kg)
- 1 second in almost 32 years
- 1 drop of ink in a large fuel tanker truck

**Particulate Matter (PM):** Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions. Common measures are $PM_{10}$ for particulate matter below 10 micrometers, and $PM_{2.5}$ for particulate matter below 2.5 micrometers. Larger inhaled particles can be trapped in the nose or upper airways. The smaller the size of particulate matter, the more likely the particle can travel farther in the lungs where particles, and contaminants adhering to particles, can be transferred to the blood stream.




Size of particulate matter in relation to common objects and relative sizes of $PM_{10}$ and $PM_{2.5}$

Source: EPA

**Pathogens:** Microorganisms, such as bacteria, viruses, or parasites that can cause disease in other organisms (i.e., humans, animals, and plants). Pathogens can be found in sewage, urban runoff, runoff from farms or rural areas populated with domestic and wild animals, and in water used for swimming. Fish and shellfish contaminated by pathogens, or the contaminated water itself, can cause serious illness (e.g., "red tide," or harmful algal bloom, results from large concentrations of aquatic microorganisms).

**Plume:** A measurable or visible discharge of a contaminant from a given point of origin. A plume can be found visible in the air (e.g., a plume of smoke) or in surface and groundwater, where it may or may not be visible.

A plume of smoke from a prescribed fire.

Source: National Park Service

**Potentially Responsible Party (PRP):** Any individual or company—including owners, operators, transporters, or generators—potentially responsible for, or contributing to a spill or other contamination at a Superfund site. Whenever possible, through administrative and legal actions, EPA requires PRPs to clean up hazardous sites they have contaminated.

**Preliminary Remediation Goal (PRG):** The concentration of a contaminant that provides a reference point for establishing site-specific cleanup levels. A PRG may be based on Federal or State drinking water standards or risk-based concentrations.

**Prevalence:** The cumulative number of existing disease cases (or health conditions) in a defined population during a specific time period.

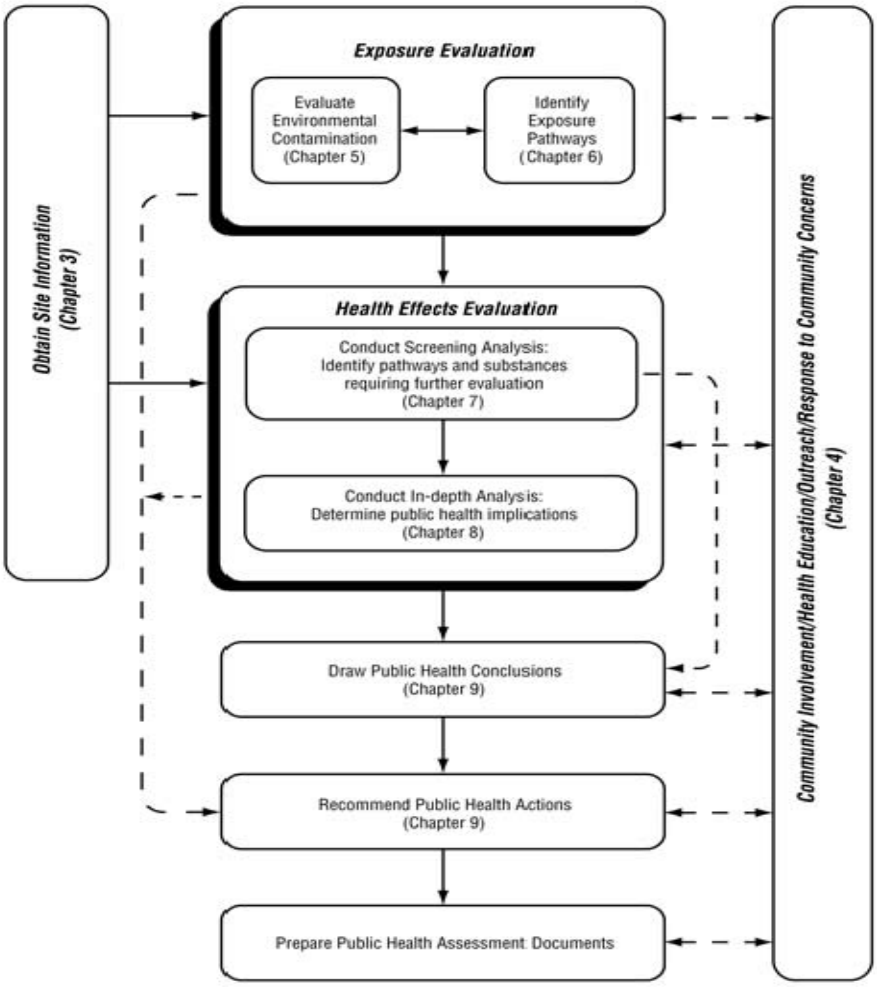
**Public Health Assessment:** A review of available information about contaminants at a hazardous waste site or facility and evaluation of whether exposure to them might cause harm to residents in the surrounding community. The Agency for Toxic Substances and Disease Registry (ATSDR) or a state public health department, through a cooperative agreement with the ATSDR, conducts public health assessments. A public health assessment is required by law to be conducted for every site on the National Priorities List. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals.

**Public Health Consultation:** Generally, a document that addresses a particular public health concern or exposure scenario and is more limited in scope than a public health assessment. The document describes any hazards at a hazardous waste site or facility and contains a public health action plan that recommends ways to stop or reduce exposure.

**Public Health Advisory:** A notice sent directly from the Agency for Toxic Substances and Disease Registry administrator to EPA's administrator that alerts EPA to a public health threat. Other government agencies, such as state and local health and environmental agencies, also are notified about the problem. A Public Health Advisory reports available information about a release of toxic material, whether people might be exposed to it, and what harm exposure might cause.

**Reference Dose (RfD):** According to EPA guidance, "the Agency's preferred toxicity value for evaluating noncarcinogenic effects resulting from exposures at Superfund sites" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

*Alternative definition: A daily oral exposure level to a contaminant that is not expected to cause any harmful health effects throughout a lifetime of exposure. RfDs generally are calculated for non-cancer health effects.*




Overview of the public health assessment process.

Source: ATSDR

**Reference Concentration (RfC):** A daily inhalation exposure level to a contaminant that is not expected to cause any harmful health effects throughout a lifetime of exposure. RfCs generally are calculated for non-cancer health effects.

**RCRA:** The Resource Conservation and Recovery Act, which was enacted by Congress in 1976. RCRA's primary goals are to protect human health and the environment from the potential hazards of waste disposal, conserve energy and natural resources, reduce the amount of waste generated, and ensure that wastes are managed in an environmentally sound manner. The RCRA Corrective Action Program which is run by EPA and 43 authorized states and territories, addresses releases of contaminants into soil, groundwater, surface water, and air by facilities that house hazardous wastes.

**Relative Risk:** The relative measure of the difference in risk between the exposed and unexposed populations. For example, a relative risk of 2 means that the population exposed to a contaminant has twice the risk of harmful health effects compared to the unexposed group.

**Regional Screening Levels (RSLs):** Risk-based concentrations derived from standardized equations used to support screening level decisions early in the Superfund cleanup process. RSLs are not cleanup standards. EPA considers RSLs to be protective for humans, including sensitive groups, over a lifetime.

**Regional Removal Management Levels (RMLs):** Risk-based concentrations derived from standardized equations used to support the decision for EPA to undertake a removal action under CERCLA. RMLs are calculated without site-specific information, but may be re-calculated using site-specific data.

**Risk:** A measure of the probability that damage to life, health, property, and/or the environment will occur as a result of a given hazard. At Superfund sites, risk is the chance that contaminants from a site will cause health and ecological problems.

**Risk Assessment:** The process by which the nature and magnitude of risks are identified. Major steps may include:

- **Data collection and evaluation:** Involves gathering and analyzing site data relevant to the human health evaluation and identifying the substances present at the site that are the focus of the risk assessment process.
- **Exposure assessment:** An exposure assessment is conducted to estimate the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed.
- **Toxicity assessment:** Considers (1) the types of harmful health effects associated with chemical exposures; (2) the relationship between the magnitude of exposure and harmful health effects; and (3) related uncertainties such as the weight of evidence of a particular chemical's carcinogenicity in humans.
- **Risk characterization:** Summarizes and combines outputs of the exposure and toxicity assessments to characterize baseline risk, both in quantitative expressions and qualitative statements.

**Risk Factor:** A characteristic (e.g., race, sex, age) or variable (e.g., smoking, occupational exposure level) associated with increased probability of a harmful health effect.

**Risk Management:** The process of determining whether or how much to reduce risk through action (i.e., evaluating and selecting alternative regulatory and non-regulatory responses to risk). The selection process necessarily requires the consideration of legal, economic, and societal factors. A risk manager is an individual or group who serves as the primary decision-maker for a site. Generally, the decisions involve regional Superfund management in consultation with members of the site team and technical staff.

**Slope Factor:** According to EPA guidance, "a plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. The slope factor is used to estimate an upper-bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a potential carcinogen" (Source: EPA Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual (Part A), 1989).

*Alternative definition: Toxicity value for a carcinogen.*

**Smelter:** A facility that melts or fuses ore, often with an accompanying chemical change, to separate its metal content. Emissions cause pollution. "Smelting" is the process involved.

**Solvent:** A solvent is a liquid that is capable of dissolving another substance to make a new solution. For example, paint remover is a solvent.

Anaconda Company Smelter Superfund Site

Source: EPA Region 8

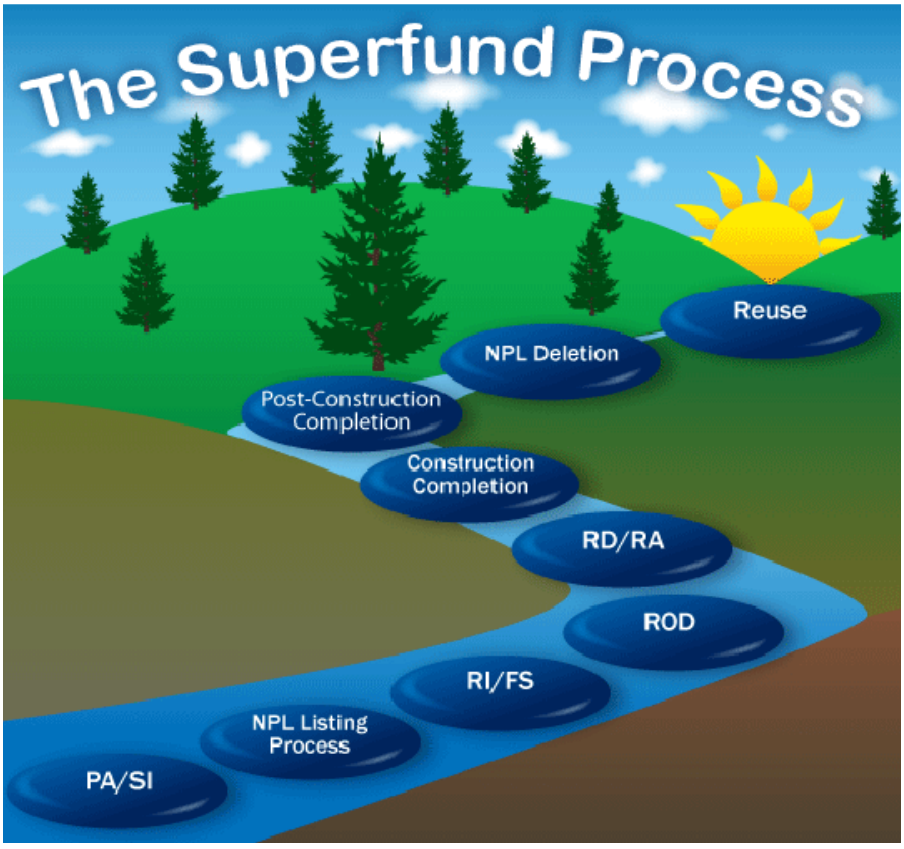
**Superfund:** The program operated under the legislative authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA) that funds and carries out EPA emergency and long-term removal and remedial activities. These activities include establishing the National Priorities List, investigating sites for inclusion on the list, determining their priority, and conducting and/or supervising cleanup and other remedial actions.

**The Three Superfund Response Actions**

**Emergency Response:** An emergency response is a short-term, emergency action that may be necessary to address a release or threat of release of a hazardous substance into the environment. EPA's emergency response program responds to chemical, oil, biological, and radiological releases and large-scale national emergencies, including homeland security incidents.

**Removal Response:** A removal response generally is a short-term action that may be necessary to address a release or threat of release of a hazardous substance into the environment. Removal responses are common at Superfund sites when the contamination poses an immediate threat to human health and the environment. Removals are classified as either time-critical or non-time-critical depending on the extent and type of contamination.

**Remedial Response:** A remedial response generally addresses long-term threats to human health and the environment caused by more persistent contamination sources. Remedial actions permanently and significantly reduce the risks associated with releases or threats of releases of hazardous substances that are serious but lack the time-criticality of a removal action.




The Superfund Process. Interactive graphic available at http://www.epa.gov/superfund/community/process.htm

Source: EPA

**Surface Water:** All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, and others).

**Toxicity:** The degree to which a contaminant or mixture of contaminants can harm living organisms.

**Toxicology:** The study of the harmful effects of contaminants on living organisms.

**Vapor Intrusion:** The migration of volatile (readily evaporating) chemicals from contaminated groundwater or soil into an overlying building.

**Volatile:** Any substance that evaporates readily.

Other glossaries to explore for additional terms:

- **EPA Superfund Glossary** - http://www.epa.gov/superfund/programs/reforms/glossary.htm
- **ATSDR Glossary of Terms** - http://www.atsdr.cdc.gov/glossary.html
- **EPA Report on the Environment (ROE)** - http://www.epa.gov/roe/glossary.htm
- **EPA's Terminology Services** - http://ofmpub.epa.gov/sor_internet/registry/termreg/home/overview/home.do
- **International Union of Pure and Applied Chemistry (IUPAC)**, Chemistry and Human Health Division Glossary (2007) - http://sis.nlm.nih.gov/enviro/iupacglossary/frontmatter.html.